

AMENDMENTS TO THE CLAIMS

1. (Currently amended) A process for preparing quaternary phosphonium salts ~~by comprising reacting a trialkyl-, trialkenyl- or triarylphosphine with an optionally substituted monounsaturated or polyunsaturated aliphatic, cycloaliphatic or aromatic-aliphatic alcohol having from 3 to 25 carbon atoms or its carboxylic acid esters or ethers in the presence of an acid, or by reacting a trialkyl-, trialkenyl- or triarylphosphine with an optionally substituted aliphatic, cycloaliphatic or aromatic-aliphatic halide having from 3 to 25 carbon atoms, which comprises carrying out the reaction wherein the reactions are conducted~~ in a ternary solvent mixture.

2. (Currently amended) The process according to claim 1, wherein, ~~to prepare the~~ quaternary phosphonium salts are of the general formula I



where

R^1 is an optionally substituted monounsaturated or polyunsaturated aliphatic, cycloaliphatic or aromatic-aliphatic group having from 3 to 25 carbon atoms,

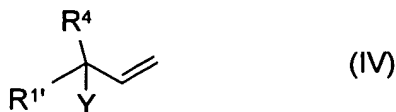
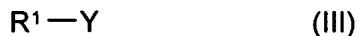
R^2 is an alkyl, alkenyl or aryl group having from 1 to 9 carbon atoms and

X is the anion equivalent of an organic or inorganic acid, and the trialkyl-, trialkenyl- or triarylphosphine are of

~~a phosphine of the~~ general formula II



where R^2 has the meaning given above, is reacted with a monounsaturated or polyunsaturated electrophile of the general formula III or IV,



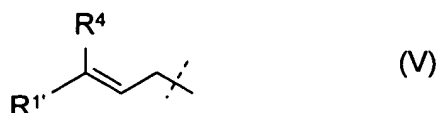
where R^1 has the meaning given above and

$R^{1'}$ is an optionally substituted, aliphatic, cycloaliphatic or aromatic-aliphatic hydrocarbon group having from 1 to 21 carbon atoms,

Y is OH, Cl, Br, $O(CO)R^3$ or OR^3 and R^3 is an aliphatic hydrocarbon group having from 1 to 6 carbon atoms and

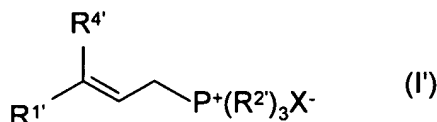
R^4 is H or CH_3 and, when an electrophile of the general formula IV is reacted,

R^1 in formula I is a structural element of the general formula V



where $R^{1'}$ and R^4 have the meanings given above.

3. (Currently amended) The process according to ~~either of claims 1 and 2 wherein, to~~
~~prepare claim 1, wherein, the~~ quaternary phosphonium salts are of the general formula I'



where

$R^{1'}$ is an optionally substituted, aliphatic, cycloaliphatic or aromatic-aliphatic group having from 1 to 21 carbon atoms,

$R^{2'}$ is an aryl group having from 1 to 9 carbon atoms,

$R^{4'}$ is H or CH_3 and

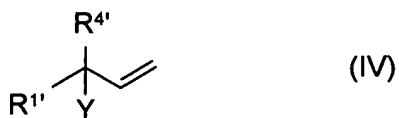
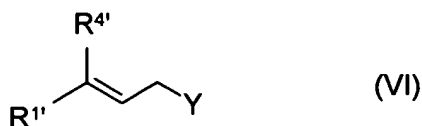
X is the anion equivalent of an organic or inorganic acid, and the trialkyl-, trialkenyl- or triarylphosphine are of

~~a phosphine of the~~ general formula II'



where $R^{2'}$ has the meaning given above,

is reacted with a monounsaturated or polyunsaturated electrophile of the general formula IV or VI,

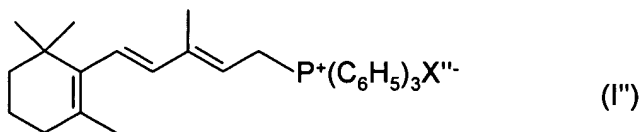


where $R^{1'}$ and $R^{4'}$ have the meanings given above and

Y is OH, Cl, Br, O(CO)R³ or OR³ and R³ is an aliphatic hydrocarbon group having from 1 to 6 carbon atoms.

4. (Currently amended) The process according to ~~any of claims 1 to 3~~ claim 2, wherein as the phosphine of the general formula II ~~use is made of~~ is triphenylphosphine.

5. (Currently amended) The process according to ~~any of claims 1 to 4, wherein, to~~
~~prepare claim 1, wherein the quaternary phosphonium salts are of the formula I'~~



where

X'' is Cl, Br or HSO₄, said phosphonium salts obtainable by reacting triphenylphosphine is reacted with β-vinylionol.

6. (Currently amended) The process according to ~~any of claims 1 to 5, wherein use is made of a~~ claim 1, wherein the ternary solvent mixture ~~comprising~~ comprises water, an alcohol having from 1 to 6 carbon atoms and a hydrocarbon having from 5 to 12 carbon atoms or a mixture of various hydrocarbons having from 5 to 12 carbon atoms.

7. (Currently amended) The process according to ~~any of claims 1 to 6, wherein use is made of a claim 1, wherein the ternary solvent mixture consisting~~ consists of water, an alcohol

having from 1 to 6 carbon atoms and a hydrocarbon having from 5 to 12 carbon atoms or a mixture of various hydrocarbons having from 5 to 12 carbon atoms.

8. (Currently amended) The process according to ~~any of claims 1 to 7, wherein use is made of a~~ claim 1, wherein the ternary solvent mixture ~~consisting~~ consists of water, methanol and a hydrocarbon having 7 carbon atoms or a mixture of various hydrocarbons having 7 carbon atoms.

9. (Currently amended) The process according to ~~any of claims 1 to 8, wherein use is made of a~~ claim 1, wherein the ternary solvent mixture ~~which consists of~~ includes at least 5% by weight of water.

10. (Currently amended) The process according to claim 1 ~~to 9, wherein use is made of a~~ the ternary solvent mixture ~~consisting~~ consists of

55-85% by weight of methanol

10-25% by weight of heptane and

5-20% by weight of water.

in which case the proportions chosen within said ranges must total 100% by weight.

11. (Currently amended) The process according to ~~any of claims 1 to 10~~ claim 1, wherein the ternary solvent mixture is in the form of a two-phase system.

12. (Currently amended) The process according to ~~any of claims 1 to 11~~ claim 1, wherein the acid is hydrochloric acid or sulfuric acid.

13. (Currently amended) The process according to ~~any of claims 1 to 12,~~
~~wherein the claim 1, further comprising separating the ternary~~ solvent mixture,
~~after the reaction is completed, is separated off from the other components of the~~
reaction mixture following completion of the reaction, and, ~~if appropriate after~~
~~setting the chosen composition by adding optionally recirculating~~ at least one of
the components of the solvent mixture, ~~is recirculated.~~

14. (Currently amended) The use of quaternary phosphonium salts of the
general formula I prepared by a process according to claim 1 ~~to 13~~ for the
synthesis of retinol (vitamin A), vitamin A acetate, vitamin A propionate, vitamin
A palmitate, retinal, retinoic acids, β -carotene, α -carotene, δ -carotene,
zeaxanthin, astaxanthin, canthaxanthin, lycopene, citranaxanthin, β -apo-8'-
carotenal, crocetin, α -cryptoxanthin, β -cryptoxanthin, phytoene, lutein, bixin,
capsanthin, capsorubin, β -apo-8'-carotenoic acid methyl ester, β -apo-8'-
carotenoic acid ethyl ester, β -apo-8'-carotenoic acid propionyl ester or β -apo-8'-
carotenoic acid palmityl ester.

15. (New) The process according to claim 3, wherein the phosphine of general formula
II' is triphenylphosphine.

16. (New) The process according to claim 1, wherein the ternary solvent mixture
consists essentially of water, an alcohol having from 1 to 6 carbon atoms and a hydrocarbon
having from 5 to 12 carbon atoms or a mixture of various hydrocarbons having from 5 to 12
carbon atoms.

17. (New) The process according to claim 5, wherein the ternary solvent mixture
consists essentially of water, an alcohol having from 1 to 6 carbon atoms and a hydrocarbon

having from 5 to 12 carbon atoms or a mixture of various hydrocarbons having from 5 to 12 carbon atoms.

18. (New) The process according to claim 5, wherein the ternary solvent mixture consists essentially of water, methanol and a hydrocarbon having 7 carbon atoms or a mixture of various hydrocarbons having 7 carbon atoms.